RESPONSE AND REQUEST FOR RECONSIDERATION

Support.

Support for the amendments to claims 1 and 18, specifying that the amine is 4-aminodiphenylamine, is found in the text of original claim 1, which lists 4-aminodiphenlamine as one of the possible amines. Support for the lower limit of Mn = 3000 in claim 22 is found on page 3, line 37. Support for new claim 23, which specifies that the amine is 3-nitroaniline, is also found in the text of original claim 1, which lists 3-nitroaniline as one of the possible amines.

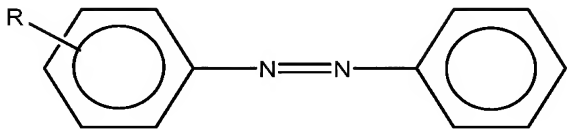
Response.

The present application relates to a composition comprising a functionalized polymer which can serve as a dispersant-viscosity modifier in a lubricant. The polymer comprises an isobutylene-diene copolymer containing carboxylic acid functionality, reacted with an amine which comprises 4-aminodiphenyl amine or (for claim 23, 3-nitroaniline).

The subject matter of the claims, prior to amendment, was considered to be novel but made obvious by a combination of Burrington (WO 01/ 98387) and Mishra (US 5,409,623). Applicants respectfully traverse.

Burrington discloses polymers derived from isobutylene and isoprene used in preparing dispersants. The polymer may be carboxylated by reacting with an α,β-unsaturated carboxylic reactant, and then with at least one of (a) amines characterized by the presence within their structure of at least one condensable H-N< group, (b) alcohols, (c) reactive metals or reactive metal compounds, or (d) a combination thereof. The amines may be monoamines or polyamines, typically polyamines, preferably ethylene amines, amine bottoms or amine condensates. The amines can be aliphatic, cycloaliphatic, aromatic or heterocyclic. (page 12.) Thus, any sort of amines can be used by Burrington, although ethylene amines are preferred and are the materials which are actually used in examples 3, 6, 9, and 13 as well as in Lubricants A and B in Examples I and II. Thus, although the possibility of using aromatic amines is mentioned, they are not the desired materials, and certainly neither the 4-aminodiphenyl amine nor 3-nitroaniline now claimed in the present application is contemplated.

Mishra discloses a derivatized graft copolymer comprising an ethylene alpha-monoolefin copolymer grafted with a carboxylic material and derivatized with an amino-aromatic material of the general formula



where R is NH_2, $CH_2–(CH_2)_n–NH_2$, or CH_2-aryl-NH_2, and the rings may be further substituted.

The aromatic amines presently claimed are not taught or suggested by Mishra. Neither 4-aminodiphenylamine nor 3-nitroaniline contain the azo linkage that is required by Mishra. There is no motivation to remove this essential feature of the amines of Mishra, the azo linkage, and use the resulting amine in place of the preferred ethylene amines of Burrington. Accordingly, it is submitted that the present invention is not even made *prima facie* obvious by a combination of these references.

Moreover, any possible *prima facie* obviousness is overcome by the unexpectedly improved performance of the materials of the present invention, especially in terms of soot handling and suspension in heavy duty diesel applications as measured by the Mack™ T-11 test. This test is described in greater detail on page 23 of the present application. It subjects engine oils to an environment which imparts enhanced amounts of combustion soot of the particular type generated by the Mack T-11 engine with exhaust gas recirculation. Lubricants which are able to maintain relatively low viscosity at higher soot levels represent a significant improvement over lubricants with lesser soot-handling ability.

In particular, the examiner's attention is directed to Example 28 and Reference Example 27, each on pages 23 and 24 of the present application. Both materials contained an oil and a commercial composition including an olefin copolymer viscosity modifier, detergent(s) overbased calcium detergent(s), phenolic antioxidant(s), corrosion inhibitor, and other conventional components.

The Reference Example, 27, in addition to the above components, also contained 2.6% (1.2% active chemical) of a succinimide dispersant with a polyisobutylene/isoprene polymeric substituent of Mn about 2400. Since the detailed chemical composition of the amine component for these examples was not taught in the Specification, the same examples are presented in greater chemical detail in the attached Declaration from Dr. Matthew Gieselman, to which the Examiner's attention is directed. The succinimide dispersant in Reference Example 27 was prepared from a polyethyleneamine as the amine component, specifically, an 80:20 mixture of "HPA-X": triethylenetetramine. Thus Reference Example 27 corresponds reasonably closely to the material of Example 13 of Burrington.

Example 28 contains, in place of the conventional succinimide dispersant of Reference Example 27, 3.1% (1.0% active chemical) of a dispersant viscosity modifier of the present invention. As indicated in the Declaration, this succinimide dispersant is a different batch of the material prepared in Example 14 of the present application: that is,

the amine was 4-aminodiphenylamine. This is the amine component of claims 1 - 21. (Also, the amount of the viscosity modifier in Example 28 was reduced slightly from that in Example 27 [5.7% by weight rather than 7.5%]. Dr. Gieselman states, in his Declaration, that in his expert opinion this change in viscosity modifier will have no effect on the soot dispersion properties of the formulation.) The number average molecular weight of the isobutylene/isoprene polymer used for this example was about 7000, which is within the limits of the present claims and in particular newly submitted claim 22.

The Table on pages 23 and 24 shows the soot-induced viscosity build-up of Example 28 and Reference Example 27. The prior art material of Example 27 exhibits a gradual increase in viscosity and a significant upward break at around 5.5% soot level (192 hours into the test). The material of Example 28 also exhibits a gradual increase in viscosity, but its significant upward break occurs around 6% soot (216 hours). This is a significant improvement in providing a lubricant which can handle an additional 0.5 % of soot, compared with the prior art. This advantage becomes particularly apparent when the data for Comparative Examples 27 and Example 28 are plotted as in the attached figure. As Dr. Gieselman states in his Declaration, The American Petroleum Institute (API) have established criteria for performance of oils in their "Service Category CI-4 plus," for use in high-speed four-stroke cycle diesel engines. Oils whose soot handling curves pass within the rectangle in the upper left portion of the attached figure fail to meet these requirements. The reference material of Comparative Example 27 fails this test, while that of Example 28 passes.

There is nothing in Burrington that would lead one to expect that by using a dispersant based on the amines of the present invention, a significant improvement in soot handling performance would be obtained such that it passes API CI-4 plus requirements. This unexpected result is evidence for the unobviousness of the present invention.

Conclusion.

For the foregoing reasons it is submitted that the present claims are in condition for allowance. The foregoing remarks are believed to be a full and complete response to the outstanding office action. Therefore an early and favorable reconsideration is respectfully requested. If the Examiner believes that only minor issues remain to be resolved, a telephone call to the Undersigned is suggested.

Respectfully submitted,

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